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COTTONSEED MEAL FOR FEEDING BEEF CATTLE.

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Cottonseed meal is a commodity which has been used for feeding cattle in the South for many years, but it is only within recent years that it has been used generally in the North and West. In the past a very large proportion of the cottonseed meal produced in this country has been exported, and much of that remaining has been used as fertilizer, so that probably less than half of the quantity produced has been used for feeding to cattle. During 1913 there were about 400,000 tons of cottonseed meal exported to Europe. For many years European feeders have shown their appreciation of this product as a feed by purchasing it in this country and paying freight on it to Europe to use for feeding purposes. It is becoming more popular as a supplementary feed in many sections of this country.

Cottonseed meal is one of the most concentrated feedstuffs found upon the market to-day. It contains from 38 to 45 per cent of protein and is therefore very valuable as a nitrogenous feed. Linseed-oil meal is one of the few feeds of vegetable origin which contain near the amount of protein found in cottonseed meal.

Cottonseed meal has a slightly greater feeding value than linseed-oil meal, and, as it is sometimes cheaper than the latter, it is often more profitable to use. At the present time (winter of 1914-15) cottonseed meal is worth about \$24 to \$28 a ton, which is an unusually low price, while oil meal is selling for about \$38 a ton. Feeders should get prices on each of these feeds and use the one which can be bought the more cheaply.

COTTONSEED MEAL FOR CALVES.

Cottonseed meal has not proved to be a good feed for very young calves. Many deaths have resulted where it was fed, and the deaths were usually attributed to the meal. Until more is learned concern-

NOTE.—This bulletin gives the results of experiments in feeding cottonseed meal to beef cattle in varying proportions and offers suggestions for its profitable use. It will be of interest to farmers and cattle raisers generally.

ing the toxicity of cottonseed meal, it is well to feed it very sparingly and with extreme caution to young calves.

For several years the Bureau of Animal Industry in the course of feeding experiments has fed beef calves ranging from 7 to 10 months of age on cottonseed meal for periods ranging from 100 to 112 days with no ill results. These calves were fed in lots containing from 24 to 52 head each. In no single lot were less than 24 head fed, so there should be practically no difference due to individuality of the animals.¹

During 1910, 77 grade beef calves were divided into three lots and fed for 119 days. The calves were started on 1 pound of cottonseed meal per day, and the quantity was gradually increased until they consumed 3.67 pounds each per day during the last month. At no time did they receive more than 4 pounds per head per day. The calves of all lots made good daily gains for the entire time, the gains ranging from 1.71 to 1.83 pounds per head. The calves fattened rapidly, and no ill results from feeding cottonseed meal were experienced, although at the end of the test two or three of the calves showed the effects of feeding by a cloudiness of the eyes. The results of the test are summarized in the following table:

Results of experiment in feeding 77 calves, Nov. 17, 1910, to Mar. 17, 1911 (119 days).

Lot No.	Daily ration.	Quantity.	Initial weight of calves.	Total gain.	Average daily gain.	Feed to make 100 pounds of gain.
		Pounds.	Pounds.	Pounds.	Pounds.	Pounds.
1	Cottonseed meal.....	2.84				179 cottonseed meal.
	Cottonseed hulls.....	7.44	338	203	1.71	435 cottonseed hulls.
	Mixed alfalfa hay.....	5.39				315 mixed hay.
	Cottonseed meal, two-thirds.....	2.34				133 cottonseed meal.
2	Corn-and-cob meal, one-third.....	1.17				65 corn-and-cob meal.
	Cottonseed hulls.....	7.50	333	210	1.76	425 cottonseed hulls.
	Mixed alfalfa hay.....	5.47				310 mixed hay.
	Cottonseed meal, one-third.....	2.38				130 cottonseed meal.
3	Corn-and-cob meal, two-thirds.....	3.87				211 corn-and-cob meal.
	Cottonseed hulls.....	7.33	328	218	1.83	400 cottonseed hulls.
	Mixed alfalfa hay.....	4.00				218 mixed hay.

The same year another lot of 52 calves were fed on cottonseed meal, cottonseed hulls, and mixed cowpea hay. They were fed for 112 days, and during that time they consumed daily 3.08 pounds of cottonseed meal, 10.01 pounds of cottonseed hulls, and 1.5 pounds of mixed cowpea hay. An average daily gain of 1.24 pounds per calf was made. The calves fattened readily, and none showed ill effects from feeding the meal. The results are summarized as follows:

Results of experiment in feeding 52 calves, 1911.

Lot.	Daily ration.	Quantity.	Initial weight of calves.	Total gain.	Average daily gain.	Feed to make 100 pounds of gain.
		Pounds.	Pounds.	Pounds.	Pounds.	Pounds.
1	Cottonseed meal.....	3.08				249 cottonseed meal.
	Cottonseed hulls.....	10.01	313	139	1.24	808 cottonseed hulls.
	Mixed hay.....	1.50				121 mixed hay.

¹ See Bureau of Animal Industry Bulletin 147 and Department of Agriculture Bulletin 73.

In 1913-14 another experiment in feeding calves on cottonseed meal was conducted. Forty-nine grade Angus calves, averaging 9 months of age were fed from December 21 to January 17, as a preliminary period to the regular feeding. During this time they were started on a ration of cottonseed meal. The following paragraph is taken from the bulletin reporting the work:¹

At the beginning of the test proper, each calf was eating daily 3 pounds of cottonseed meal, approximately 20 pounds of corn silage, and 4 pounds of hay. The allowance of meal was raised gradually throughout the whole period of 76 days, until at the last each calf was eating 6 pounds daily. At one time each calf was consuming as much as 28 pounds of silage each day, but they would not continue to eat this much, so at the end of the period (Apr. 1) they were eating an average of only 20 pounds per calf per day. The allowance of hay was gradually decreased from the first. At the middle of the period each calf consumed daily not over 3 pounds of hay, and near the end an exceedingly small allowance met their desires. From the middle of March to April 1 they averaged less than 1 pound of hay per calf per day.

These calves consumed on the average 4.4 pounds of cottonseed meal per day for 76 days, and were eating about 6 pounds of cottonseed meal during the latter part of the feeding period, but no ill results were experienced.

The following summary gives the daily ration, the initial weight of the calves, the daily gain, and the amount of feed required to make 100 pounds gain.

Results of experiment in feeding 49 calves, 1913-14.

Lot.	Daily ration.	Quantity.	Initial weight of calves.	Total gain.	Average daily gain.	Feed to make 100 pounds of gain.
1	Cottonseed meal..... Corn silage..... Hay.....	Pounds. 4.4 23.9 2.76	Pounds. 456	Pounds. 104	Pounds. 1.37	Pounds. 323 cottonseed meal. 1,741 corn silage. 201 hay.

COTTONSEED MEAL FOR THE BREEDING HERD.

It is not advisable to feed bulls on large quantities of cottonseed meal for long periods, as the opinion prevails among many stockmen that it impairs the breeding powers of the animal. It can be fed to them in reasonable quantities throughout the winter, however, with little danger. From 2 to 3 pounds of cottonseed meal may be fed daily along with some other feeds, such as crushed corn, bran, corn silage, and some good hay.

For feeding to breeding cows there is no feed which equals cottonseed meal in small quantities. The breeding herd can be wintered very economically by feeding about 2 pounds of cottonseed meal per head per day with some silage, stover, and other farm roughage.

¹ Department of Agriculture Bulletin 73.

In 1912 a large herd of breeding cows were wintered in Mississippi by feeding them 2 pounds of cottonseed cake per day, with all the oat straw they would consume and what roughage they got from the old corn and cotton fields. The cattle were wintered very economically, as they were fed but three and one-half months, and they were in good condition when spring came. In one experiment in Alabama¹ the cows were permitted to run in the stalk fields and in a small canebrake all winter, and from January 23 to May 7 they were given about 2 pounds of cottonseed cake per day. They were in fair condition when spring came and had been wintered very economically.

Throughout Virginia, Maryland, and parts of the corn belt the cows may be run in the stalk fields until about November 15, when they should be taken up and fed about 2 to 2½ pounds of cottonseed meal per day, 15 to 30 pounds of corn silage, depending upon the amount available, and what other roughages they will eat, such as corn stover, hay, and straw. In sections where losses have occurred from cornstalk disease, the practice of turning cattle into the stalk fields should not be followed. If there is no silage, a small quantity of corn may be used with the cottonseed meal and the other farm roughages. A pound of cottonseed meal is usually worth about 2 pounds of corn, so a farmer can readily calculate which will be the more profitable feed.

FOR STOCKER CATTLE.

There are few combinations of feed which are more economical than a ration of corn silage and cottonseed meal for wintering stocker cattle. Two pounds of cottonseed meal, combined with what corn silage stocker steers will eat, will cause them to gain slightly in weight. The cost of wintering such cattle can usually be lessened by permitting the steers to run in the stalk fields and giving feed at night only. Straw and other roughages which can not be used to advantage in any other way may be fed with the silage and cottonseed meal. If it is desired to make the steers gain in weight throughout the winter, preparatory to fattening on grass during the summer, the ration of cottonseed meal may be increased.

The Bureau of Animal Industry, in cooperation with the Alabama experiment station, conducted tests in wintering steers during three winters from 1907 to 1910.² Each year one lot of steers was permitted to range in the old cotton and cornstalk fields and over some waste land, while a second lot ran on similar range, but received in addition a small ration of cottonseed meal and cottonseed hulls. The results are given in the following table:

¹ Department of Agriculture Bulletin 73.

² See Bureau of Animal Industry Bulletin 131 and Department of Agriculture Bulletin 110.

COTTONSEED MEAL FOR FEEDING BEEF CATTLE.

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Results of experiments in feeding steers during three winters.

WINTER OF 1907-8 (84 DAYS).

Lot.	Daily ration.	Average initial weight per steer.	Average gain (+) or loss (-) of each steer.	Average daily gain (+) or loss (-) of each steer.
		Pounds.	Pounds.	Pounds.
1	Range alone.....	722	- 97	- 1.15
2	Range plus 2.35 pounds cottonseed meal and 8.5 pounds cottonseed hulls.....	726	- 6	- .07

WINTER OF 1908-9 (98 DAYS).

1	Range alone.....	705	- 106	- 1.08
2	Range plus 2.41 pounds cottonseed meal and 8.71 pounds cottonseed hulls.....	705	+ 3	+ .03

WINTER OF 1909-10 (91 DAYS).

1	Range alone.....	637	- 106	- 1.16
2	Range plus 2.4 pounds cottonseed meal and 8.9 pounds cottonseed hulls.....	633	+ 43	+ .47

When the cattle got no feed except stalk fields they lost about 103 pounds per head each winter, while the steers which received 2.4 pounds of cottonseed meal and 8.7 pounds of cottonseed hulls in addition to the range held their own throughout the winter and weighed as much in the spring as they did at the beginning of winter.

COTTONSEED MEAL FOR FATTENING MATURE CATTLE.

The fattening of mature cattle on cottonseed meal and cottonseed hulls has been practiced in the South for many years. Formerly the cattle were fed in large numbers near oil mills, and the steers were fed very heavily on the by-products. Steers were frequently fed as much as 12 to 15 pounds of cottonseed meal per head a day. As a result of such heavy feeding, many became blind, exhibiting a staggering gait, and occasionally swelled in the legs below the hocks. Some would die, while others would cease gaining in weight, go off feed, and then rapidly lose flesh. Even though the feed was changed, much trouble was experienced in getting the animals back to a normal appetite and a thrifty condition.

When steers are not fed over 7 pounds of cottonseed meal a day they can usually be fed for 100 to 120 days without showing any signs of cottonseed-meal sickness. If silage or other succulent feed is given as roughage the meal can be fed much longer without harmful results.

When cattle are fed a ration composed of cottonseed hulls and meal alone they usually make exceedingly good daily gains for the first 60 days, after which time the gains begin to diminish rapidly,

and unsatisfactory gains are usually secured after 90 to 100 days. For a short feeding period cottonseed hulls and meal give satisfactory results. If the roughage is silage instead of hulls the daily gains are more uniform throughout the feeding period; and if care is used in feeding the meal can be fed for 150 days without ill effects.

The Bureau of Animal Industry has conducted experiments in cattle feeding continuously since 1904, and the results bear out the statements given above. Feeding done by Curtis, of the North Carolina agricultural experiment station,¹ also emphasizes the statements regarding the daily gains of cattle fed on cottonseed meal with hulls or silage as the roughage.

With the prices of cottonseed meal such as have prevailed during the last few years, the heavy feeding of this meal has proved uneconomical.

In a number of experiments made at the North Carolina station, where steers were fed different quantities of cottonseed meal, those that received 9 pounds a day made slightly larger daily gains than those getting smaller quantities, but the gains were much more expensive, and the profit was smaller.² Similar results were secured in several tests conducted by the West Tennessee experiment station.³ Greater profit was made on steers which were fed from 5 to 7 pounds of cottonseed meal a day than on steers which were fed 7 to 9 pounds a day. The feeding of cottonseed meal with silage gave larger daily gains, cheaper gains, better finish, and more profit than feeding cottonseed meal with hulls.

The Indiana experiment station found that the average Indiana rations could be greatly improved by the addition of 2½ pounds of cottonseed meal for each steer daily.⁴ The addition of cottonseed meal to a ration containing clover hay resulted in increased gains, more economical gains, and a greater profit. Cottonseed meal proved to be better for balancing a ration than soy-bean meal, as the latter had a laxative tendency.⁵ The steers would not eat as much feed, made smaller daily gains, and did not sell as well when soy-bean meal replaced the cottonseed meal in a ration of shelled corn, cottonseed meal, oat straw, and corn silage.

The addition of cottonseed meal to rations of shelled corn and clover hay, and shelled corn, clover hay, and silage, resulted in more feed being consumed, as the cottonseed meal did not decrease the quantity of other feeds consumed, but acted as a stimulant.⁶

The analysis of cottonseed meal indicates it to be superior to linseed meal, and some feeders consider it so, but tests made at the

¹ North Carolina Station Bulletins 219 and 222.

⁴ Indiana Station Bulletins 129 and 136.

² North Carolina Station Bulletin 222.

⁵ Indiana Station Bulletin 167.

³ Tennessee Station Bulletin 104.

⁶ Indiana Station Bulletin 129.

Nebraska experiment station indicated that there was little difference in feeding value, the slight difference being in favor of linseed meal.¹

COTTONSEED MEAL OR CAKE FOR PASTURE FEEDING.

For years feeders of the Southwest have used cottonseed cake for feeding to steers on pasture in the fall and early winter and at times when the grass was covered with snow. The fattening of cattle on grass with cottonseed cake during the spring and summer months had not been practiced to any extent when the Bureau of Animal Industry started some tests to determine whether such feeding would be profitable.² These feeding experiments have been conducted for seven years with large numbers of cattle each year. In most cases each lot of cattle consisted of one or more carloads. Cottonseed cake was always fed in preference to the meal. It was broken into nut size and sacked at the mill. In regard to feeding cake in preference to meal, a former publication of the bureau is here quoted:

This cake can be purchased in the large cake size, just as it comes from the press, for about \$2 per ton cheaper than in the nut size. Some feeders find that it pays to break the cake on their farms. The cake is the same as cottonseed meal except that it is not ground into meal. There are several advantages in feeding cake in place of meal, especially in summer feeding. A rain does not render the cake unpalatable, but it will often put the meal in such a condition that the cattle will not eat it. Again, no loss is incurred with the cake during windy days, whereas the meal, when fed in the open pasture, is sometimes wasted on account of the winds. Furthermore, the cake requires chewing before being swallowed and therefore must be eaten very much slower than the meal, so when a number of steers are being fed together the greedy one has little chance to get enough cake to produce scours. When cottonseed meal is fed the greedy steer often scours because he can bolt the meal and get more than his share; this not only injures the steer, but makes the bunch "feed out" unevenly.

The cake was fed in troughs in the pasture. The steers were started with a ration of $1\frac{1}{2}$ pounds per head per day, and the quantity was gradually increased until the thirty-fifth day when they were eating 5 pounds per day. Some steers did not take readily to cottonseed cake and had to be coaxed into eating it by sprinkling a very little salt over it and withholding salt at other times. After they once began eating cake there was no further trouble, as they ate it greedily.

Each year one lot of cattle was grazed without additional feed, while another lot was grazed and in addition received a supplemental ration of cottonseed cake. Several years' work tends to show conclusively that the feeding of cottonseed cake to cattle on pasture caused the cattle to gain in weight faster, to fatten more rapidly, to develop greater "bloom," and to make greater profits than similar

¹ Nebraska Station Bulletin 100.

² See Bureau of Animal Industry Bulletins 131 and 159 and Department of Agriculture Bulletin 110.

cattle which received pasturage alone. Persons desiring further information on this subject should consult Bureau of Animal Industry Bulletins 131 and 159 and Department of Agriculture Bulletin 110.¹

SUMMARY.

In conclusion, it would be well for feeders to bear in mind the following points:

- (1) Do not feed young calves heavily on cottonseed meal.
- (2) Secure prices on both cottonseed meal and linseed meal and use the cheaper feed.
- (3) If cottonseed meal does not cost over \$34 a ton it can probably be used to advantage in wintering the breeding herd.
- (4) By feeding a ration of 2 pounds of cottonseed cake with corn silage, or 2½ pounds of cottonseed cake with coarse roughages such as oat straw, corn stover, etc., mature cattle can be wintered very economically.
- (5) One pound of cottonseed meal is usually worth as much as 2 pounds of corn for feeding cattle.
- (6) In sections where much corn, stover, fodder, timothy, or other carbohydrate feeds are used, it is extremely important that some feed like cottonseed meal be used.
- (7) Cottonseed meal stimulates the appetite of fattening animals and causes them to consume more feed and likewise to make greater gains.
- (8) Heavy feeding of cottonseed meal should be discontinued after 100 to 120 days where dry roughage is fed and after 150 days where succulent feeds are used.
- (9) Cottonseed cake can be used very profitably as a supplemental feed for fattening cattle on pasture.
- (10) Five times as many farmers should be using cottonseed meal as are doing so at the present time. Are you one of them?

¹ These bulletins may be purchased from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 10 cents each for the first two and 5 cents for the last.